

CMPT481 Project Report

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PROBLEM AND MOTIVATION

In 1980, the ratio for debt-to-income in Canada was 66%; that ratio passed 150% in 2011.¹ At a young age many Canadians are taught how to count and spend money; however not all are taught how to budget effectively. Whether you are a business owner, student, or bringing home the bacon for your family; it is important to budget. Budgeting allows a person to determine if they will have enough money for their needs and allows them to plan for the things they want. The reason people fall in to debt is that they are spending more than they expected to spend. If a person was to plan ahead and set aside a predetermined amount of money for each week or month and could visualize their spending habits it would allow them to better prioritize their budget and find areas to increase savings.

It can be easy to forget to add expenses as they occur throughout the day. Some reasons for this are that the method of inputting their expenses may be too time-consuming or difficult to use; or that their budgeting application is not available on their mobile device. Many of the current applications that are purposed towards tracking weekly or monthly recreational budgets (non re-occurring bills and expenses) are not easy to use or engaging for the user. Visualization techniques present in other applications tend to focus solely on the amount of money spent in each category, however this overlooks the primary purpose of budgeting and does not deliver the information of how the amount spent relates to the user's savings goals. Many applications sacrifice ease-of-use by adding clutter for additional (often unused) features. When navigating many of these applications it can seem like there is too much going on. Accessibility of the application can also be an issue, disparity in the interface between the Desktop and mobile versions can be a confusing experience. Some applications are not available on all devices.

RELATED LITERATURE AND BACKGROUND

DESCRIPTION OF THE SYSTEM

Initial Prototype

The intention was to build an application that was as easy to use as possible, users should be able to jump

¹Raj K. Chawla and Sharanjit Uppal. "Household debt in Canada". In: *Perspectives on Labour and Income*. 24.2 (June 2012). <http://www.statcan.gc.ca/pub/75-001-x/2012002/article/11636-eng.htm>, p. 1.

right into the tasks without prior training and be able to complete them confidently and successfully. The easiest way to accomplish this was to minify the scope of the application to its simplest possible subset. Minimizing the number of actions available simplifies the interface and allows the user to navigate confidently.

In the initial "Wizard of Oz" style paper prototype the interface was pared down to only 3 screens, one for each of the tasks users are allowed to perform:

- Add an expense
- View expenses
- Customize budget allowances

As with any design process it was quickly discovered during trials that it was unclear how to perform certain actions; for instance there was no functionality for cancelling or removing an expense. Each hiccup was noted and changes were prioritized for the next prototyping stage.

Adjustments

The next prototype was constructed as a fully interactive and functional web application using Javascript, html and CSS. This allowed us to implement the functionality which was missing from our paper prototypes such as animations, calculations, and the use of real data.

A critical analysis was performed on the data collected from the paper-prototype trials. This inspired a focus on displaying the information available as clearly as possible. Naturally the implementation met some obstacles and decisions were made to cut or work around some features. Features which were cut or altered include:

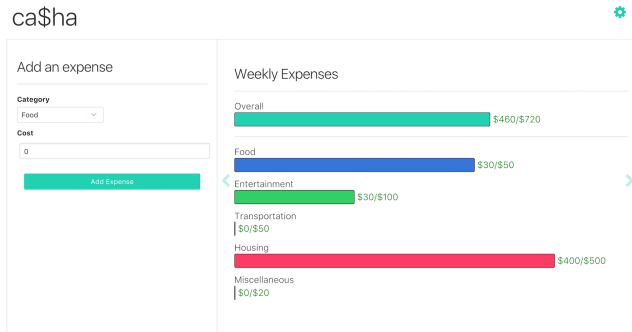
- Saving data across sessions
- Cancelling expenses
- Viewing individual expenses
- Cancel buttons/back buttons
- Adding additional expense categories

Many features were determined to be "nice to have" but not crucial for the testing stage of this level of prototype. These concerns are addressed again in the retrospective portion of the report.

Overall the choice of web technologies suited the imple-

mentation well; particularly the ability to use the same prototype on mobile and desktop. A familiarity with React and Redux allowed quick bug-free edits when concerns regarding functionality or layout were raised. The use of Redux specifically simplified the problem of syncing data across the application trivial. These choices were made within a forward thinking context, if the application were to move forward to large scale deployment the code may progress towards that goal.

Figure 1. Desktop Interface



One of the greatest difficulties was that of creating a responsive layout that allowed code re-use across Mobile and Desktop devices. The preference was for the interfaces to be similar enough to allow habits formed on one device to transfer to the other. To this end CSS media-query rules were used extensively alongside the responsive CSS framework Bulma.io. Google Chrome's developer tools were instrumental in testing the interface on multiple mobile devices.

Another challenge was the limited screen real-estate on mobile devices. Navigation items needed to be accessible without getting in the way. Additional complexity was added to the application to hide and show certain screens since there is not enough room on a mobile device for all screens to be showing at the same time.

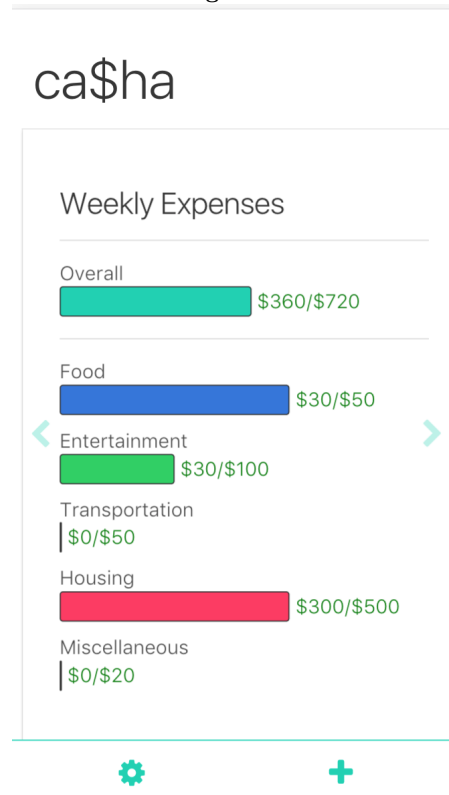
Retrospective

As expected, user testing of the interactive prototype revealed yet more flaws, but also successes in the design.

The application failed to account for the change in idioms between mobile and desktop; for instance users tried to edit categories or add expenses by touching interface elements. Most users mentioned that they would like more functionality, many of the requested features were originally part of the design but were left out due to time constraints, cluttering of the interface, or implementation difficulties.

It seemed that the most difficulty encountered by users was found in navigating between features and the discoverability of functionality. This suggests that this is an area of potentially large benefit with lower amounts of work.

Figure 2. mobile Interface



Some requested features were deliberately left out. One user mentioned that they prefer that their budgeting app links to their bank account and tracks their expenses automatically, this pedigree of feature was not only this out of scope for the time-frame of the project, but it is also contrary to the design principles of being as simple as possible. Several other features would be rejected for the purposes of keeping the interface clean and simple.

EVALUATION WITH USER REPORTS

Goals, Approach and Rational for the Evaluation

Goals

The primary goal of our project is for users to use our application to continuously track their expenses. It is our belief that if the application is easy to use through an intuitive interface and navigation then the user will also be able to input expenses quickly and efficiently. If the user can quickly tell us how much they have spent in a specific category after expenses have been entered then it confirms that the application is presenting a clear visualization of the data. Unfortunately the continued use of the application can not be tested within the scope of this class since that would require multiple interviews with the test users to evaluate their usage and a high-fidelity prototype.

Approach and Rational for the Evaluation

Interviews were employed to evaluate our goals. The questions were designed to determine what users require to make their budgeting experience with the application the most enjoyable.

Actual Participant Pool and Other Execution Details

A mixture of family and friends represented the users for the test cases that follow.

User 1 An individual who has limited experience with computers.

User 2 An individual who has a degree in computer science and may offer some valuable criticisms.

User 3 Older demographic who has budgeted using other methods in the past.

User 4 A business student who has studied budgeting.

Divergence from Milestone III Evaluation Plan

Upon implementing the Medium Fidelity-Prototype the task list had diverged from what the original scope of functionality had been. Instead of only three tasks, the application could now perform five different tasks:

- Add an expense (unchanged)
- View expenses over a weeks/months/years time (unchanged)
- Change an overall budget (unchanged)
- Change a category name
- Set a budget limit for one or all categories

It had originally been planned that the redesign would offer cancellation of actions (forms etc.) to improve the user experience, however due to implementation difficulties this feature was not included.

Results

While examining the results from the interviews it was clear that there were both positive and negative themes. The users appeared to have a preconceived notion of how the application should work from applications they had used in the past, even from apps unrelated to budgeting. Due to this (unintentional) knowledge transfer many users were confused for reasons we had not anticipated.

Some common themes amongst the users were:

- Enjoyed Similar interfaces between mobile and desktop
- It was easy and quick to add expenses
- The animations were pleasing

The similarity between the desktop and mobile versions of the application allowed users to switch between the two with minimal confusion once they had learned how to use the application. The animations engaged the users when they had added expenses into the application, one user was surprised and said "Oh! Fancy."

Some users requested additional features:

- Additional customization
 - Ability to pick default view
 - Ability to add more categories
- More in-depth data
- Ability to click a category's label or the bar to edit the name of the category or view more data.
- Cancel Buttons

The users wanted to be able to change the default view of budgeting data so they could choose which charts were visible (from weekly/monthly/yearly). Some also wanted the option to be able to see a record of individual expenses as their primary view. These requests show the general theme that that users wanted more data about their habits to be available to them; e.g. a breakdown of each individual expense, the amount they spent, and when and where they spent it. Most users intuitively thought that additional data could be accessed by clicking on the category name/chart (though the feature had not been implemented).

Confusion occurred in regards to the charts because many users were unsure as to the scale of the chart (when no budget limit for a category was set the default was \$100). Users wanted an indicator that they were close to their budget limit.

There were some idiosyncracies of the prototype that caused confusion as well. Due to the way the prototype was implemented, refreshing the page or clicking the "back" button on the browser would erase any expenses that had been entered. This of course was simply a limitation of the current phase of prototype. The fact that the application was simply a website also caused difficulty when one user cried out in frustration as they hit their phone's back button to return to the previous page, but instead closed the application entirely.

User #2 mentioned some design ideas; suggesting to create a widget for mobile devices and to provide customization options through the widget. Perhaps the user could see total amount spent from the budget, see the total remaining amount from the budget, or some combination of the above.

User #4 suggested that making the "Add Expense" page the default screen would make adding expenses even quicker.

It was observed by all users that the cost totals on the charts became cut off as their expenses neared their budget amount. There was a strong usability concern that the textbox for customizing budget amounts on the settings page was too small on mobile devices.

Conclusion

The overall opinion of the interface was quite positive and it met the initial goals well. The layout of the in-

terface was effective, it was easy to use and users had very little trouble performing the provided tasks. As before mentioned, the most pervasive theme was that users wanted to be able to do more with the application; such as adding more categories and to be able to more closely track their spending. In this regard the application could still use some improvement.

Though it was not feasible to test whether users continued to use the application over time, the majority of testers said that given a fully functional version they would use it regularly. As for the primary goal of having a simple and quick to use interface it is clear that the application was a success. The testing showed that users could quickly add expenses and that they found the charts easy to read.

FINAL RECOMMENDATIONS

The application could still stand to gain a lot in the way of usability from some minor tweaks however the chosen approach was valid. The tweaks would include augmenting the interface to make it more complete. This would allow for more customizability and a better break down of the spending as was requested by the users. The settings icon would also be changed since this confused some of the users. The addition of labels to the icons would solve this confusion.

Reflection on Design Process

Originally the plan was to implement a very simple and slimmed down design for a budgeting application the biggest observation since that initial plan is that users wanted more functionality then they actually need. The simple interface let them easily track basic expenses and fulfilled all the basic needs of simple budgeting, however users requested many "nice to have" features which did not contribute directly to this goal.

The overall design of our application changed because of the users. The analysis of the evaluations of the low-fidelity prototype resulted in a reorganization of the application layout. Many buttons on the interface were moved. One button was found to be redundant and was removed. Within the medium fidelity prototype there were many potential changes to allow users more customizability.

We learned a lot about the user-centered design process over the course of the project. The process allowed using feedback to improve the interface and it is a process that would be beneficial for future projects. It was decided in hindsight that there are a few things that should have been done differently. The first being that more time should have been spent on refining the low-fidelity prototype and that it should have been more interactive. Some of the issues that appeared in the medium fidelity prototype, such as the setting button, could have been discovered in the low-fidelity prototype. Using a different prototyping tool for the low-fidelity prototype may have also made it easier to find these

issues.

The chosen approach for evaluating the prototype worked well and gave enough information to judge the interface. The semi structured interviews provided lots of information on different aspects and relayed the reactions users had to the product. Some issues were discovered by observing the users interacting with the interface, a couple of them wanted to touch the chart to add an expense to a category. Using a questionnaire or some other less expressive medium an issue like this would likely not be discovered. Using a semi-structured interview was effective.

In this course we learned a lot of useful skills for developing a user interface. One of the skills that is most useful is how to plan and test an interface before implementation. Building and iterating on the low-fidelity prototypes is a cost effective way to test effectiveness before further investment. In a personal project this would save a lot of time, in a commercial project this would save a lot of money. Planning the interface is a skill that will transfer well into future careers. Learning to interview and get feedback from users was another useful skill. The ability to extract information from a user is very important, and will apply in the workplace when requesting feedback or obtaining requirements for a project. There are many lessons from this project that could be applied to future projects and interface designs.

APPENDICES

A1 - Evaluation Instrument

Tasks Performed by Users

- Add different expenses to three different categories
- After adding expenses, go to the data visualization screen
- Change the name of a category
- Change the overall budget limit from its default
- Change one category limit
- Add more expenses to that category to go over the budget limit

Pre-Demo

- Do you currently or have you ever budget(ed)?
 - (Yes - Probing Question) What method do you use?
 - (No - Probing Question) Is there a specific reason why?

Post Desktop Demo

- Was there anything that you found to be counter-intuitive?
- If you could change/add anything about the app, what would it be? (From desktop perspective)

Post Mobile Demo

- Was there anything that you found counter-intuitive?
- If you could change/add anything about the app, what would it be? (From mobile perspective)

Post-Demos

- Compare and contrast the mobile interface and the desktop interface.
 - (Probing Question) Which was easiest to use?
 - (Probing Question) Which made the data more visually clear for you?
- Compare and contrast this budgeting application with others you've used.
 - (Yes - Probing Question) Which app allowed faster input?
 - (Yes - Probing Question) Which app allowed more accurate input?
 - (Yes - Probing Question) Are you more likely to continue using this application or a different one?
 - (No - Probing Question) Why?
- (If they had not budgeted before) If this application were available to you, would you be likely to continue using it?

A2 - Raw Data

User #1

Pre-Demos

- Do you currently or have you ever budget(ed)?
 - Yes, using pen and paper.

Desktop Demo

- Add three expenses to three different categories
 - Tried to click on the expenses graph to add an expense
 - Made an error adding an expense to the housing category, accidentally added it to the food category
- changing the name of a category
 - Did not recognize the settings button
 - Found it easy to add the new category name
 - Wanted to add a new category not change the name

Post Desktop Demo

- Was there anything thing that you found counter-intuitive?
 - found the setting button confusing, a label would be helpful
- If you could change/add anything about the app, what would it be? (From desktop perspective)
 - Some way of correcting an amount if input incorrectly would be good

Mobile Demo

- Add two expenses to two different categories
 - Took some time to find the plus button
- Asked to go to yearly expenses view

Post Mobile Demo

- Was there anything thing that you found counter-intuitive?
 - No, found the cross over from the desktop made it easy to use
 - Wished there was more touch interaction on the mobile version
- If you could change/add anything about the app, what would it be? (From mobile perspective)
 - I would change the same things as with the Desktop version

Post-Demos

- Compare and contrast the mobile interface and the desktop interface.
 - It was nice that they both had the same features available
 - * (Probing Question) Which was easiest to use?
 - * Mobile was the easiest to use more used to that platform
- Compare and contrast this budgeting application with others you've used.
 - Never used a computer for budgeting before but found this easy to use
- (Probing Question) Are you more likely to continue using this application or a different one?
 - Yes I would continue to use the application since it is easier and neater then using paper and pen

User #2

Pre-Demos

- Do you currently or have you ever budget(ed)?
 - Yes. Right now User #2 doesn't budget actively but they do use Mint.com to make sure old accounts don't have stuff on them and go through current accounts to ensure there are no unknown purchases.
In the past they used spreadsheets for projecting, and sometimes User #2 still uses this method for their savings and for bigger purchases.
User #2 says that they have a facade for budgeting. "Mint.com sucks for things that run over multiple months."

Desktop Demo

- Add three expenses to three different categories
 - Saw animations and said "Aw thats fancy"
 - Didn't use the arrows to increment/decrement
 - Added negative numbers
 - Found out he could input 'e' (didn't do anything except clear any numbers previously typed) When asked why the letter User #2 answered "only because I was allowed to"
- Go to monthly view
 - Highlighted "Weekly View"
 - Went into Settings then hit browser back button and that caused the application to close
- Change the overall budget
 - Tried to add -0.10, changed to "NaN"
- Max a category
 - Entered 9.99 then entered 0.01 and it didn't max the category

Post Desktop Demo

- Was there anything thing that you found counter-intuitive?
 - Switching between views, the arrows on side made User #2 thing that it would go to a history. "Although the forward wouldn't make sense for this."
 - Click category label to change the name
- If you could change/add anything about the app, what would it be? (From desktop perspective)
 - Expected a drop down to toggle views
 - Add back button to settings page (or a cancel button)
 - Hover over category label to see a button to edit the name
 - Want to be able to see if you're increasing or decreasing spending of money or if theres a certain time of the year you're spending more money (VERY IMPORTANT TO USER - Charting over time)
 - Can't see actual expenses of what you're spending per day on what day
 - Only tracking expenses and not income

Desktop Demo

- Add two expenses to two different categories
 - Used "Add Another"
- Asked to go to yearly expenses view
 - Didn't swipe

Post Mobile Demo

- Was there anything thing that you found counter-intuitive?
 - No, but there were things I'd change
- If you could change/add anything about the app, what would it be? (From mobile perspective)
 - On Add Expense Page
 - * Make it grey, or have a notification to say why you can't add an expense
 - * Can't do anything if there is no category selected, but can do something if there is no expense inputted, weird
 - In settings
 - * Add back or cancel button
 - On main page
 - * Change arrows to three dots to know to swipe
 - It would be cool to have a widget so you can add an expense really easily without having to open the app. Customizable widgets too, so if you wanted a quick add expense button, or if you wanted to just see where you were budget wise(total amount spent versus remaining budget amount, OR only total spent, OR only remaining budget amount)

Post-Demos

- Compare and contrast the mobile interface and the desktop interface.
 - It was nice that they both had the same features available. Mint.com disables some features for their mobile application
 - * (Probing Question) Which was easiest to use?
 - Desktop was easiest to use because I can use the refresh button to get out of the settings page without having to hit "Save"
 - * (Probing Question) Which made the data more visually clear for you?
 - No difference
- Compare and contrast this budgeting application with others you've used.
 - It's not a fair comparison because mint.com is a professional product made by an international finance company
 - Your app is easier to use if you are not wanting to have it tied to bank accounts, and is easier to add expenses.

- I like Mint.com because it has the ability to track not just the value of what you spent but also when and what the expense was for
- (Probing Question) What app allowed you faster input?
 - For cash expenses your app is faster, or for expenses if you can't link an account
 - Mint.com credit card expenses are delayed, however debit transactions are faster
- (Probing Question) What app allowed more accurate input?
 - It's the same, both can still see what the amount is before it gets used
 - For choosing categories your app is harder, Mint doesn't require me to worry about a box (for inputting the amount)
- (Probing Question) Are you more likely to continue using this application or a different one?
 - It has potential, but I wouldn't currently use it. If I were to use it I would want to include location and date of the expense. US is okay as is, not ideal. I want to be able to go back and change past expenses. I want more data out of the program. Don't want expenses to be summed up. Want monthly budget or yearly budget, don't care about weekly budget. In fact, I want monthly budget to be the default view, and it not be a sum of the weekly budget. Also the ability to add income and assets, or my specific bank accounts.
 - * (Probing Question) With those changes would you use this app over Mint.com consistently?
 - With those changes? Yes.

User #3

Pre-Demos

- Do you currently or have you ever budget(ed)?
 - I sort of budget, I write down and calculate my spending on paper to track it.

Desktop Demo

- Add three expenses to three different categories
- Change the name of a category

Post Desktop Demo

- Was there anything thing that you found counter-intuitive?
 - I do not like that it was weekly, couldn't find the monthly version. Tends to budget on a monthly basis.
 - I would like it if you could set the monthly view as default
 - wished that she would could go to a different page then come back and the data would stay (we have no server connected)
- If you could change/add anything about the app, what would it be? (From desktop perspective)

- I would like to customize the colours more and add more category
- Would like to see a break down on when and what things were spent on

Mobile Demo

- Add two expenses to two different categories
- Asked to go to yearly expenses view

Post Mobile Demo

- Was there anything thing that you found counter-intuitive?
 - I don't like have to press the plus compared to the desktop but this is because i had to use the desktop first.
 - Could of flipped graphs to make them all fit on the screen
- If you could change/add anything about the app, what would it be? (From mobile perspective)
 - Make the format similar to the desktop so that the add expenses is shown all the time
 - Some sort of remove button to fix amounts that are added

Post-Demos

- Compare and contrast the mobile interface and the desktop interface.
 - Once I got used to the mobile interface it was as good as the desktop and as easy to use
 - * (Probing Question) Which was easiest to use?
 - Found the desktop easier because everything was on one page
 - * (Probing Question) Which made the data more visually clear for you?
 - It was easier to see the graphs on the mobile since that is all that was on the page
- After testing this app, would you be likely to continue using it consistently?
 - Yes I would continue to use, It is easier to use then with pen and paper. I also found it faster to use overall since it would always be right there on my phone.

User #4

Pre-Demos

- Do you currently or have you ever budget(ed)?
 - Personally? No, maybe, technically yes. Never followed it. User #4 created a budget for the sake a creating a budget. Doesn't believe budgets to be beneficial. Here we talked about some pros and cons.
 - * "I'm a seasonal worker, would make more sense to budget if I had a consistent income."
 - "Wouldn't it then make more sense to budget? You know you have this much money for these many months, budget to make sure you end by breaking even or by ending in a surplus."

- User #4 says their way of budgeting is by asking "do I have enough money for the year?" Where they are "Naturally frugal" they don't make many big purchases and when they do it doesn't make a big difference.

Desktop Demo

- Add three expenses to three different categories
 - User #4 had tried using the arrows to increment the amount he was adding but quickly changed to the num pad.
 - Asked for clarification if he was adding an expense for a day/week/month/year
- Change the name of a category
 - Clicked on the category name
 - Clicked on the drop down for adding expenses to a specific category
 - Clicked on the settings gear and said "ahh"

Post Desktop Demo

- Was there anything thing that you found counter-intuitive?
 - "Add an expense" text makes him think that he can click on it to add an expense, didn't immediately realize it was a title.
 - Not immediately drawn to the settings gear, clicked on the category title, then the category bar, then the category drop down (that you want to add an expense to) to try to change the name of the category first.
 - Scrolling arrows to increment added expense amount is weird, goes up by one.
- If you could change/add anything about the app, what would it be? (From desktop perspective)
 - Have the arrows to increment added expense increment amount by 10
 - Have category names/bars clickable to change category name/add expense/see total expenses
 - See the arrows to change between weekly/monthly/yearly be more prominent. Didn't notice that until the interviewer pointed them out.
 - Have it be more customizable
 - * Wants to be able to have more categories (more than 5)

Desktop Demo

- Add two expenses to two different categories
 - User #4 missed the "Add Another" button
 - * After he added the second expense the interviewer asked him to add another expense but this time click that button instead of "Done"
- Asked to go to yearly expenses view
 - Swiped immediately

Post Mobile Demo

- Was there anything thing that you found counter-intuitive?
 - "Add Another" button - wasn't sure it would save first entry
 - Pressing back button on mobile device ruined data
 - Clicking save "what if I don't want to save it?"
 - swiping was intuitive - didn't notice arrows though
- If you could change/add anything about the app, what would it be? (From mobile perspective)
 - In settings
 - * Change it so that you can see what you're typing in for a category limit
 - * Have more categories!
 - On main page
 - * Click the category label/bar to add expense
 - * Don't like that you can't see budget numbers on screen
 - * Add indicator that you're getting close to the budget limit, have a bar, half of what you've spent, half what you have left in budget to spend
 - * See what you're spending day/month

Post-Demos

- Compare and contrast the mobile interface and the desktop interface.
 - Gear was much better on mobile, had to figure it out still though
 - Pretty much the same
 - Desktop has stuff you can do from the main page, mobile has another screen (quick and easy to use)
 - * (Probing Question) Which was easiest to use?
 - Both were easy
 - * (Probing Question) Which made the data more visually clear for you?
 - Desktop because on mobile the screen is cramped. Have mobile main screen be add expense and data be a separate page showing all weekly/monthly/yearly on one page.
- (If they had not budgeted before) After testing this app, would you be likely to continue using it consistently?
 - No. It doesn't do much. Want to view list of individual expenses.
 - More data, what days you spent, how much you spent, how it changes week to week.

References

Chawla, Raj K. and Sharanjit Uppal. "Household debt in Canada". In: *Perspectives on Labour and Income*. 24.2 (June 2012). <http://www.statcan.gc.ca/pub/75-001-x/2012002/article/11636-eng.htm>.